

CLAIMS

We claim:

1. An apparatus for reordering sequence indicated information units into proper sequence, comprising:

a double-back shifter receiving sequence indicated information units; and

at least one circuit coupled to said double-back shifter to repetitively compare, reorder and shift said sequence indicated information units so as to be in proper sequence when shifted out of said double-back shifter.

2. The apparatus according to claim 1, wherein said double-back shifter comprises:

a first plurality of storage units configured to shift contents from one to another in a first direction, and individually capable of storing a sequence indicated information unit; and

a second plurality of storage units configured to shift contents from one to another in a second direction opposite to said first direction, said second plurality of storage units individually capable of storing a sequence indicated information unit and coupled to said first plurality of storage units such that a last one of said first plurality of storage units shifts its contents into a first one of said second plurality of storage units.

3. The apparatus according to claim 1, wherein said at least one circuit repetitively compares sequence indicators included in sequence indicated information units stored in sets of corresponding storage units of said double-back shifter, and reorders sequence indicated information units stored in associated storage units of said sets according to said comparisons.

4. The apparatus according to claim 3, wherein storage units in a shifting order of said first plurality of serially coupled storage units are paired with storage units in a reverse shifting order of said second plurality of serially coupled storage units to be included in said sets of corresponding storage units of said double-back shifter.

5. The apparatus according to claim 4, wherein said at least one circuit is configured to perform a single column, double shift mode of operation.

6. The apparatus according to claim 4, wherein said at least one circuit is configured to perform a multi-column mode of operation.

7. The apparatus according to claim 4, wherein said at least one circuit is configured to perform a single shift mode of operation.

8. The apparatus according to claim 1, wherein said information units include sequence indicators for SONE payload transmitted to a destination including said double-

back shifter through a switch fabric from at least one source.

9. The apparatus according to claim 8, wherein said at least one source, said destination and said switch fabric are in a multi-shelf system.

10. The apparatus according to claim 8, wherein said sequence indicated information units include source indicators indicating sources of received SONET payloads, and said at least one circuit only compares and reorders sequence indicated information units having source indicators indicating a same source.

11. The apparatus according to claim 8, wherein said switch fabric includes a plurality of switch slices.

12. The apparatus according to claim 11, wherein said plurality of switch slices form a distributed switch fabric.

13. The apparatus according to claim 11, wherein a length of said double-back shifter is determined from the number of said plurality of switch slices and a skew between best and worst case transit times for sequence indicated information units transmitted to said destination from said plurality of switch slices.

14. The apparatus according to claim 11, further comprising:

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a plurality of path buffers included in said destination and individually configured to receive SONET payloads transmitted from a corresponding one of said plurality of switch slices; and

a staging shifter including a plurality of storage units individually corresponding to a respective one of said plurality of path buffers so that sequence indicated information units of received SONET payloads are periodically loaded into said plurality of storage units at a cell transfer rate and shifted into said double-back shifter before a next loading.

15. The apparatus according to claim 14, wherein said cell transfer rate is equivalent to a rate that a SONET payload is transmitted from said switch fabric to said destination.

16. The apparatus according to claim 14, wherein said sequence indicated information units individually further include a payload location pointer.

17. The apparatus according to claim 14, wherein said sequence indicated information units individually further include a valid entry indicator, and said at least one circuit only compares and reorders sequence indicated information having valid entry indicators indicating valid entries.

18. A method for reordering sequence indicated information units into proper sequence, comprising repetitively comparing, reordering and shifting sequence

indicated information units in a double-back shifter so as to be in proper sequence when shifted out of said double-back shifter.

19. The method according to claim 18, wherein said repetitively comparing, reordering and shifting comprises:

(a) shifting top and bottom rows of said double-back shifter so as to shift at least one new sequence indicated information unit into at least one vacated position in said top row, shift at least one sequence indicated information unit from said top row to said bottom row, and shift at least one sequence indicated information unit out of said bottom row that is in proper sequence relative to all other sequence indicated information units in said double-back shifter;

(b) comparing sequence indicators of said sequence indicated information units residing in corresponding positions of said top and said bottom rows of said double-back shifter, and reordering sequence indicated information units in associated positions of said top and said bottom rows according to said comparisons; and

(c) repeating (a) to (c) to process an incoming stream of sequence indicated information units.

20. The method according to claim 19, wherein said shifting comprises shifting top and bottom rows of said double-back shifter one position at a time.

21. The method according to claim 19, wherein said shifting comprises shifting top and bottom rows of said double-back shifter more than one position at a time.

22. The method according to claim 18, wherein said repetitively comparing, reordering and shifting comprises:

(a) shifting sequence indicated information units in a bottom row of said double-back shifter, and shifting at least one sequence indicated information unit out of said bottom row in proper sequence relative to all other sequence indicated information units in said double-back shifter;

(b) comparing sequence indicated information units stored in corresponding positions of a top row of said double-back shifter and said bottom row of said double-back shifter, and reordering said sequence indicated information units in said double-back shifter according to sequence indicators included in said compared sequence indicated information units;

(c) shifting said sequence indicated information units in said top row of said double-back shifter, shifting in at least one new sequence indicated information unit into at least one vacated position in said top row, and shifting at least one sequence indicated information unit from said top row to said bottom row;

(d) comparing sequence indicated information units stored in corresponding positions of a top row of said double-back shifter and said bottom row of said double-back shifter, and reordering said sequence indicated information units in said double-back shifter according to sequence indicators included in said compared sequence indicated information units; and

(e) repeating (a) to (e) to process an incoming stream of sequence indicated information units.

23. The method according to claim 22, wherein said (a) and (c) respectively comprise shifting said bottom and top rows of said double-back shifter one position at a time.

24. The method according to claim 22, wherein said (a) and (c) respectively comprise shifting said bottom and top rows of said double-back shifter more than one position at a time.

25. The method according to claim 18, further comprising:

receiving SONET payloads transmitted through a distributed switch fabric from a source; and

shifting at least one sequence indicated information unit of said SONET payloads into said double-back shifter upon each shift of said top row of said double-back shifter.

26. The method according to claim 25, wherein said repetitively comparing, reordering and shifting comprises comparing and reordering sequence indicated information units having source indicators indicating a same source.

27. The method according to claim 25, wherein said repetitively comparing, reordering and shifting

comprises comparing and reordering sequence indicated information units having valid entry indicators indicating valid entries.

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